LEE & KIM
PATENT & TRADEMARK ATTORNEYS
5TH F. NEW SEOUL Bldg. 828-8
YOKSAM 1-DONG KANGNAM-KU
SEOUL 135-935, KOREA
TEL : 82-2-553-7770
FAX : 82-2-558-7770
www.lnk.ip.com

October 13, 2005

IPEA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 920 Dunsan-dong, Seo-gu,
Daejeon Metropolitan City 302-701,
Republic of Korea

Re: International Application No. PCT/KR2004/000729
in the name of OPTOMECHA CO., LTD. et al.
Our Ref: FP04017

Dear Sirs:

The applicants want to amend the description and claims of the above-identified PCT application in response to the written opinion of the ISA. Replacement sheets are attached hereto.

Differences between the description and claims as originally filed and those as amended hereby will be explained below.

In the Description

Page 5, line 28, cancel "an incident angle" and substitute "an inclination angle".

Page 5, line 29, cancel "a gradient" and substitute "a gradient value".

Page 6, line 2, cancel "the incident angle" and substitute "the inclination angle".

Page 6, line 2, cancel "the gradient" and substitute "the gradient value".

Page 6, line 7, cancel "from the center of the image sensor" and substitute "between the corresponding parts and the center of the image sensor".

Page 6, lines 11 ~ 18, cancel " In order to ... the image sensor." and substitute "In order to achieve the above-described object of the invention, there is provided an image sensor comprising: a substrate in which an array of photoelectric elements is formed; and an array of optical path conversion elements for converting optical paths of incident light formed at a light incident side of the substrate so that the optical path converted light may be incident on the substrate, each optical path conversion element being formed to match with each photoelectric element, wherein an incident surface of each optical path conversion element has a tangent line gradient value to convert the optical path of light incident slantingly on a peripheral area of the image sensor at a larger inclination angle as the peripheral area is away from the center of the image sensor to be identical with the optical path of light incident vertically on a central area of the image sensor to counterbalance the inclination angle of light incident on the peripheral area of the image sensor, the tangent line gradient values of corresponding parts of the incident surfaces of the optical path conversion elements at an identical distance from the respective matching photoelectric elements being different from one another according to distances between the corresponding parts and the center of the image sensor.".

Page 6, line 20, cancel "different incident surface gradients" and substitute "different incident surface gradient values".

Page 7, line 13, cancel "the image sensor" and substitute "the single image sensor".

Page 7, line 15, cancel "the identical tangent line gradients" and substitute "the identical tangent line gradient value".

Page 7, line 17, cancel "different tangent line gradients" and substitute "different tangent line gradient values".

Page 7, line 18, cancel "from the center of the image sensor" and substitute "between the corresponding parts and the center of the image sensor".

Page 8, line 17, cancel "an incident angle and a gradient" and substitute "an inclination angle and a gradient value".

Page 9, line 4, cancel "an incident angle and a gradient" and substitute "an inclination angle and a gradient value".

Page 10, line 6, cancel "an incident angle" and substitute "an inclination angle".

Page 10, line 7, cancel "a gradient" and substitute "a gradient value".

Page 10, lines 20 ~ 21, cancel "an incident angle" and substitute "an inclination angle".

Page 10, lines 29, cancel "the incident angle" and substitute "the inclination angle".

Page 11, line 5, cancel "the incident angle and the gradient" and substitute "the inclination angle and the gradient value".

Page 11, line 8, cancel "the incident angle" and substitute "the inclination angle".

Page 11, line 13, cancel "the incident angle" and substitute "the inclination angle ϕ_1".

Page 13, lines 5 ~ 6, cancel "from the center of the image sensor" and substitute "between the corresponding parts and the center of the image sensor".

Page 13, line 8, after "elements 1." insert "That is, the aspheric micro lens and aspheric micro reflecting mirror have different tangent line gradient values on individual parts of the incident surface of the same optical path conversion element to condense incident light to the photoelectric element.".

Page 13, line 19, cancel "an incident angle" and substitute "an inclination angle".

Page 13, line 20, cancel "a gradient" and substitute "a gradient value".

Page 13, line 25, cancel "light" and substitute "incident light".

Page 13, line 26, cancel "a refraction angle" and substitute "an angle of reflected light to a normal line of the incident surface".

Page 14, lines 1 ~ 2, cancel "an incident angle" and substitute "an inclination angle".

Page 14, line 15, cancel "the incident angle and the gradient" and substitute "the inclination angle and the gradient value".

Page 14, line 18, cancel "the incident angle" and substitute "the inclination angle".

Page 15, line 25, cancel "from the center of the image sensor" and

substitute "between the corresponding parts and the center of the image sensor".

Page 18, lines 3, 5, 7, and 21, cancel "the incident angle" and substitute "the inclination angle".

Page 18, lines 14, 16 ~ 17, 18, 19, and 20, cancel "an incident angle" and substitute "an inclination angle".

In the claims

Original claims 1 to 9 are cancelled.

Original claim 10 is replaced by amended claim 10 as follows:

10. An image sensor, comprising:

a substrate in which an array of photoelectric elements is formed; and

an array of optical path conversion elements for converting optical paths of incident light formed at a light incident side of the substrate so that the optical path converted light may be incident on the substrate, each optical path conversion element being formed to match with each photoelectric element,

wherein the optical path conversion elements are selected from the group consisting of aspheric micro lenses and aspheric micro reflecting mirrors, the aspheric micro lens and aspheric micro reflecting mirror having different tangent line gradient values on individual parts of an incident surface of the same optical path

conversion element to condense incident light to the photoelectric element, and

the incident surface of each optical path conversion element has a tangent line gradient value to convert the optical path of light incident slantingly on a peripheral area of the image sensor at a larger inclination angle as the peripheral area is away from the center of the image sensor to be identical with the optical path of light incident vertically on a central area of the image sensor to counterbalance the inclination angle of light incident on the peripheral area of the image sensor, tangent line gradient values of corresponding parts of the incident surfaces of the optical path conversion elements at an identical distance from the respective matching photoelectric elements being different from one another according to distances between the corresponding parts and the center of the image sensor.

Original claim 11 remains unchanged.

Original claim 12 is replaced by amended claim 12 as follows:

12. The image sensor of claim 10, wherein, when it is presumed that a refraction index of a layer contacting the incident surface of the aspheric micro lens is 'n_1', the inclination angle between light incident on the incident surface of the aspheric micro lens and the optical axis is 'ϕ_1', a refraction index of the aspheric micro lens is 'n_2', and an angle of refracted light to the optical axis for light incident to one point on the incident surface of the aspheric

micro lens to be refracted by the aspheric micro lens and condensed to the photoelectric element is 'ϕ_2', a tangent line gradient α at the point on the incident surface of the aspheric micro lens is represented by following formula:

$$\alpha = \tan^{-1}\left(\frac{n_1 \sin\phi_1 - n_2 \sin\phi_2}{n_1 \cos\phi_1 - n_2 \cos\phi_2}\right) .$$

Original claim 13 is replaced by amended claim 13 as follows:

13. The image sensor of claim 10, wherein, when it is presumed that the inclination angle between light incident on the incident surface of the aspheric micro reflecting mirror and the optical axis is 'ϕ_3', and an angle of reflected light to the optical axis for light incident to one point on the incident surface of the aspheric micro reflecting mirror to be reflected by the aspheric micro reflecting mirror and condensed to the photoelectric element is 'ϕ_4', a tangent line gradient β at the point on the incident surface of the aspheric micro reflecting mirror is represented by following formula:

$$\beta = 90° + \frac{\phi_3 + \phi_4}{2} .$$

Original claim 14 is replaced by amended claim 14 as follows:

14. The image sensor of one of claims 10 to 13, wherein the centers of the optical path conversion elements are offset from the centers of the matching photoelectric elements according to the distances from the center of the image sensor.

Original claim 15 is replaced by amended claim 15 as follows:

LEE & KIM

15. The image sensor of one of claims 10 to 13, wherein, when the single image sensor is divided into a plurality of regions according to the distances from its center, the optical path conversion elements in the same region have the identical tangent line gradient value on the corresponding parts of the incident surfaces, but the optical path conversion elements in the different regions have different tangent line gradient values on the corresponding parts of the incident surfaces according to the distances from the center of the image sensor.

Original claims 16 to 18 are cancelled.

Please accordingly proceed with the international preliminary examination for the above-identified application based on the amended description and claims.

Very truly yours,
LEE & KIM

Seon-Min Kim

Encl.